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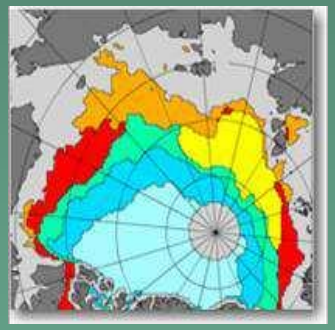
# Marine Mammals and Diminishing Sea Ice

**Impacts of an Ice-Diminishing Arctic on Naval and Maritime Operations**
**June 20-22, Washington, D.C.**


U.S. Department of the Interior
U.S. Geological Survey

# Objectives of Presentation

- Overview of the most common sea ice-associated marine mammals of Alaska
- Provide a conceptual model of the impacts of diminishing sea ice on marine mammals of Alaska
- Characterize overall sensitivities of U.S. Arctic marine mammals with special emphasis on polar bears and Pacific walrus
- Review status of Alaska sea-ice associated marine mammals with special reference to the ESA

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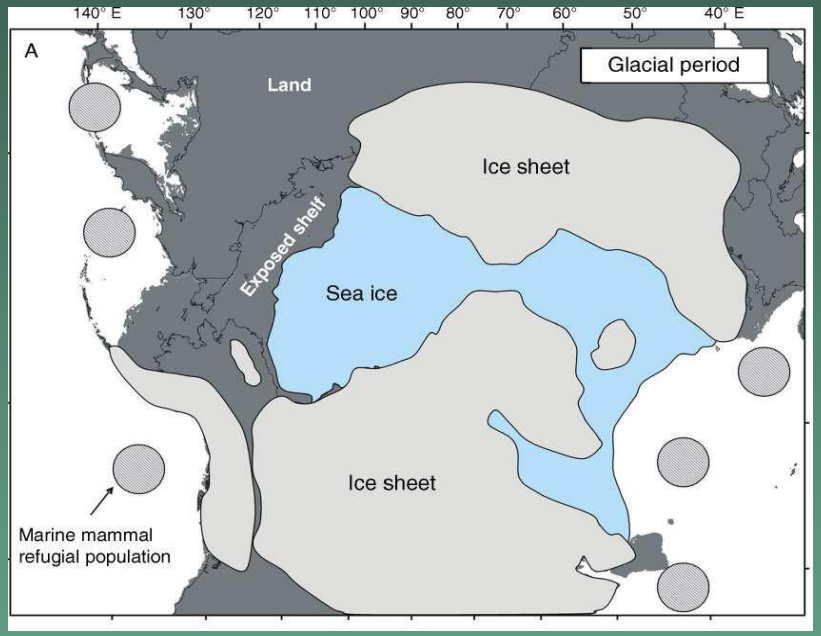
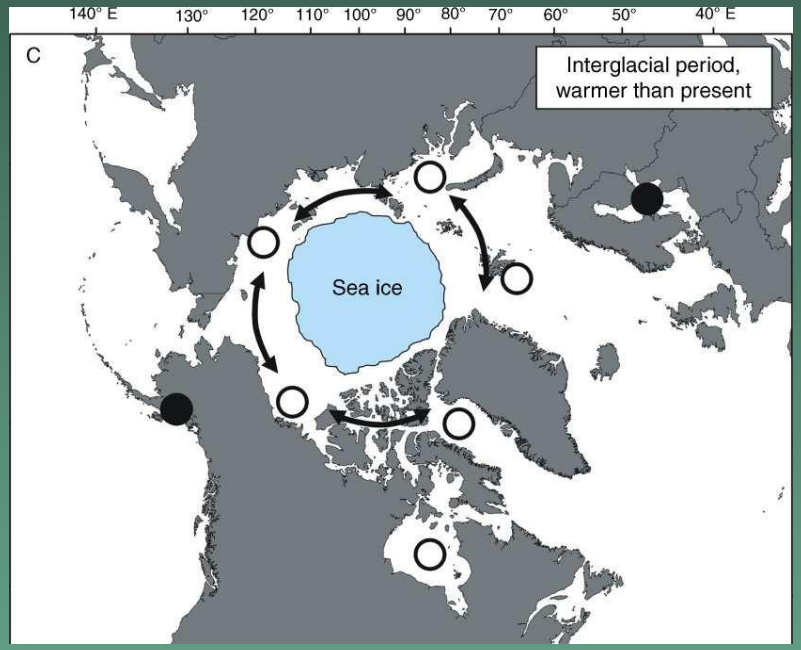
# Temporal Context – Marine mammals have survived warmer and colder periods than at present. But transitions were gradual. Current change is rapid; occurring against a modern backdrop.




O'Corry-Crowe. 2008. Ecological Applications 18: S56-S76

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# Arctic and Sub-arctic marine mammals of Alaska

- Bowhead whale
- Beluga
- Ringed seal
- Bearded seal
- Polar bear
- Pacific walrus

- Spotted seal
- Ribbon Seal
- Fin whale/Minke whale
- Gray whale
- Humpback whale
- Killer whale

Bearded Seal

*Erignathus barbatus*

Ringed Seal

*Phoca hispida*

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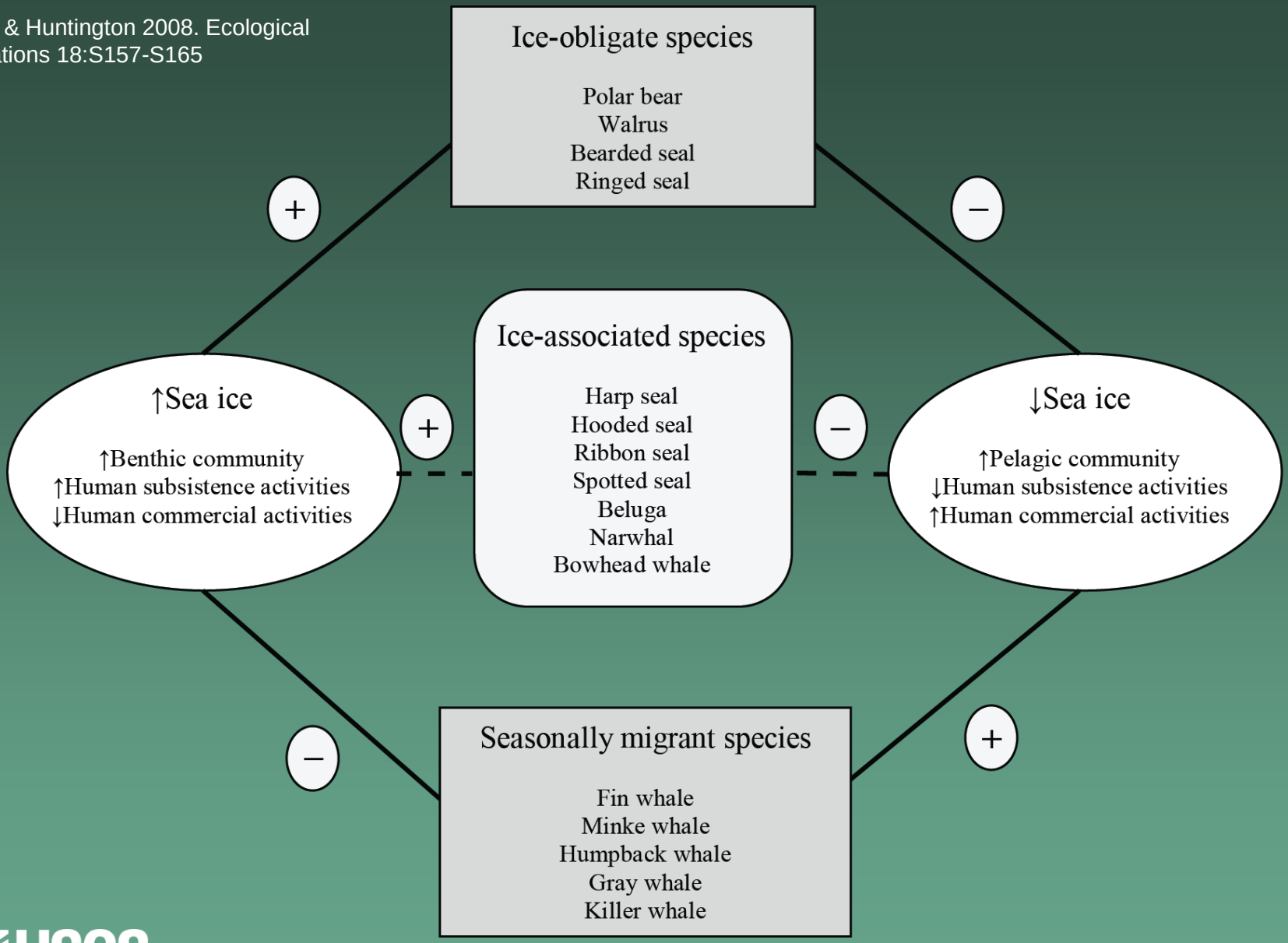
NOAA

Moore & Huntington 2008. Ecological Applications 18:S157-S165

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Laidre et al. 2008. Ecological Applications 18: S97-S125

Laidre et al. 2008. Ecological Applications 18: S97-S125

**Bearded Seal**

*Erignathus barbatus*

**Ringed Seal**

*Phoca hispida*

**Spotted Seal**

*Phoca largha*

**Ribbon Seal**

*Histriophoca fasciata*

- **Effects of Climate Change on ice seals are unclear**
- **Potential sensitivities include:**
  - **Give birth, nurse pups, and molt their coats on sea ice; earlier timing of melt may compromise ability of ringed and bearded seals to reproduce and molt successfully**
  - **Ringed seals create sub-nivean (under wind-blown snow) lairs to give birth and nurse pups, have relatively long lactation period, and tend to follow sea ice**
  - **Bearded seals are benthic feeders – access the sea floor from sea ice over continental shelf**
  - **Modifications to trophic pathways, e.g. relaxation of tight pelagic-benthic coupling in Chukchi Sea; ocean acidification; diminished prey species , e.g., arctic cod, associated with sea ice**

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Beluga Whale

*Delphinaptera leucas*

Bowhead Whale

*Balaena mysticetus*

*Photo by K. Laidre*

- **Effects of Climate Change on “ice” whales are unclear**
- **Potential sensitivities include:**
  - **For bowhead whales potential competition with other whales, particularly grays, if latter move into Beaufort Sea and overwinter in the North**
  - **Modifications to trophic pathways – competition for zooplankton with invading fish species; ocean acidification**
  - **Vessel strikes from large vessels in narrow leads?**

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NOAA

- **Emerging clarity on effects of diminishing sea ice on polar bears**
- **Effects include:**
  - **Lack of ice = lack of access to primary prey, ice seals**
  - **Longer time spent on land (fasting) and on sea ice far from shore**
  - **Reduced survival of old and younger animals (Western Hudson Bay) and cubs of the year (Alaska)**
  - **Smaller body size and reduced body condition**
  - **Smaller population size (Western Hudson Bay)**

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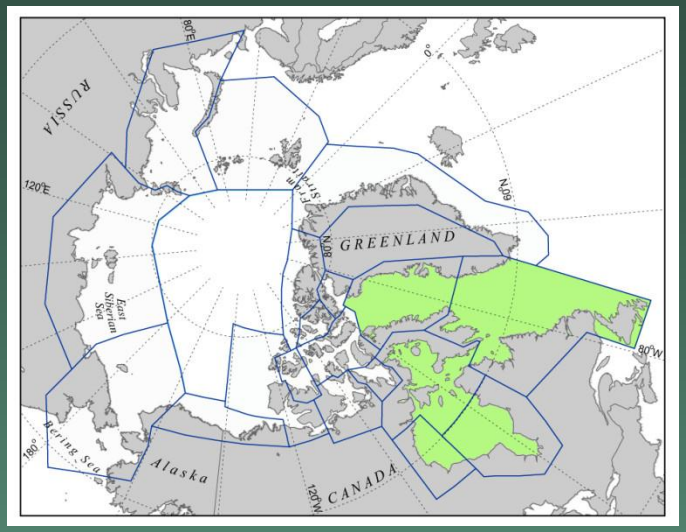
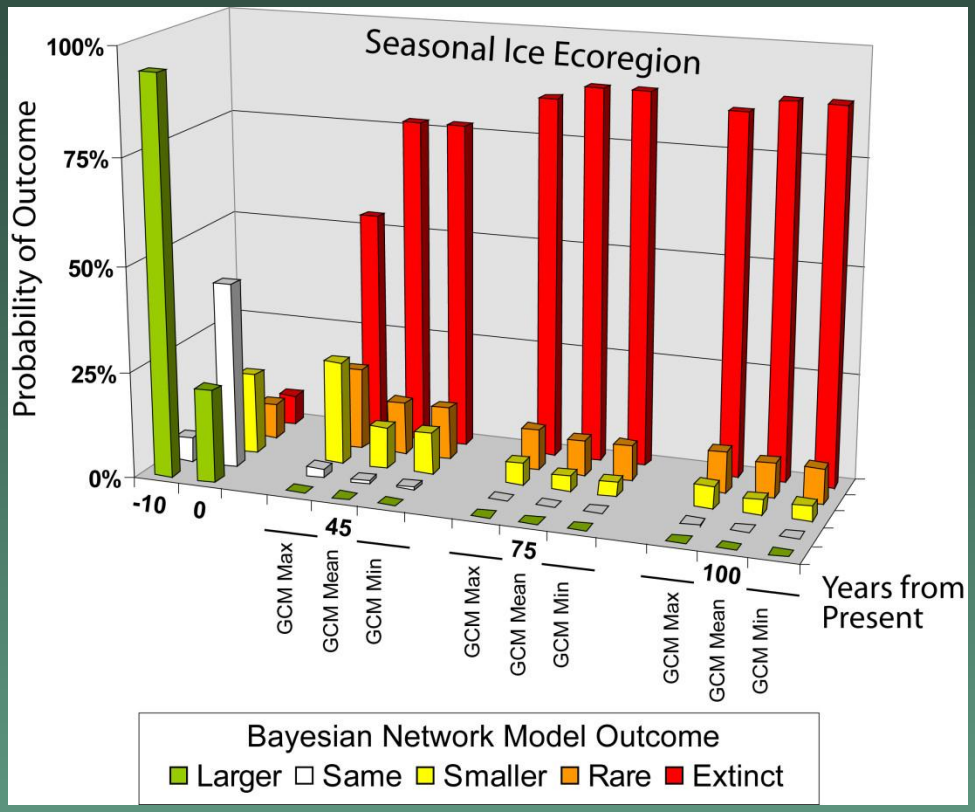

RUSSIA
120°E
East Siberian Sea
GREENLAND
60°N
80°W
Bering Sea
180°
Alaska
CANADA
120°W


Seasonal Ice Ecoregion
Probability of Outcome
100%
75%
50%
25%
0%
-10
0
45
75
100
GCM Max
GCM Mean
GCM Min
Years from Present
Bayesian Network Model Outcome
Larger
Same
Smaller
Rare
Extinct

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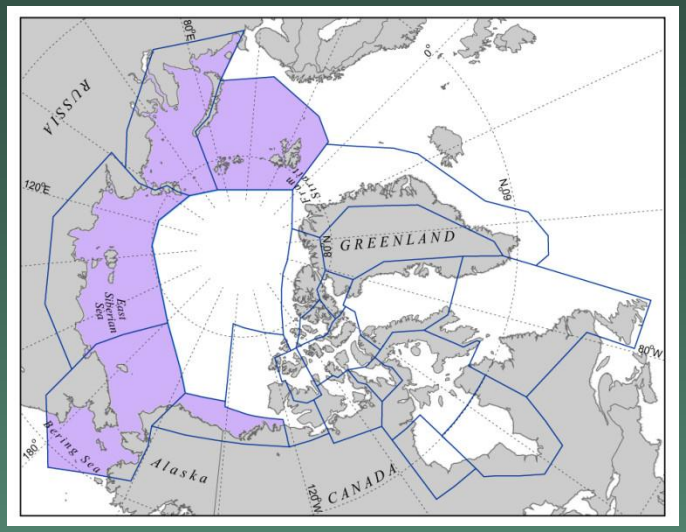
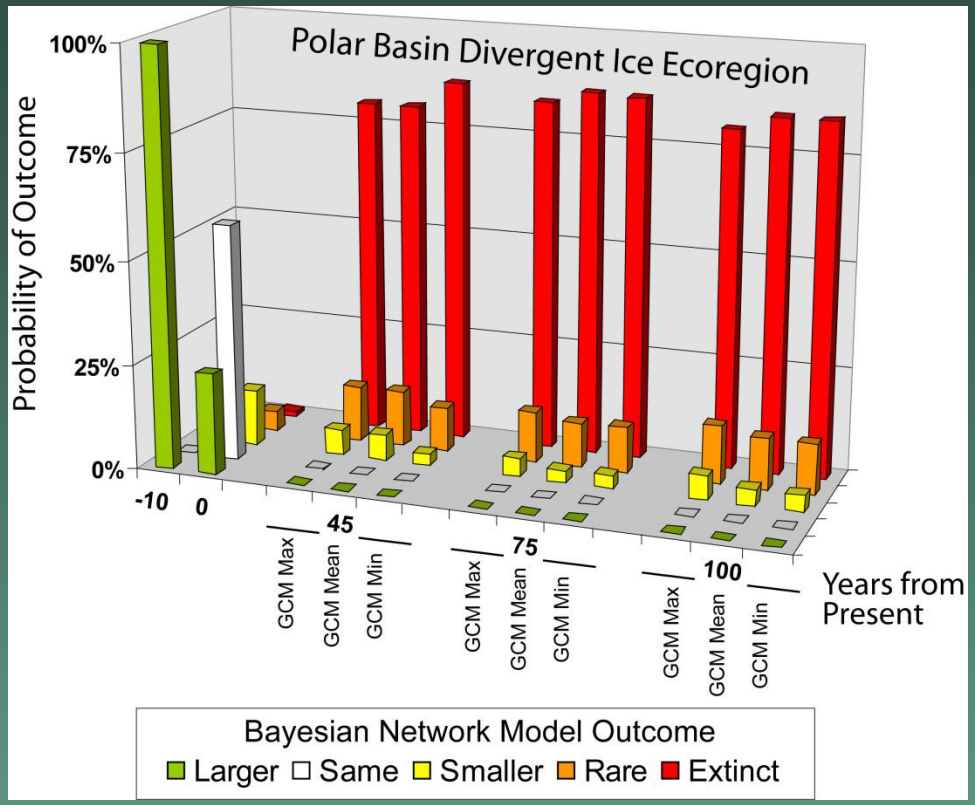

RUSSIA
GREENLAND
Alaska
CANADA
Bering Sea
East Siberian Sea
120°E
180°
120°W
90°W
60°W
60°N
90°N
0°


Polar Basin Divergent Ice Ecoregion
Probability of Outcome
100%
75%
50%
25%
0%
-10
0
45
75
100
GCM Max
GCM Mean
GCM Min
Years from Present
Bayesian Network Model Outcome
Larger
Same
Smaller
Rare
Extinct

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- **Uncertainty about effects of diminishing sea ice on Pacific walruses**
- **Potential effects include:**
  - **Increasing numbers of walruses onshore in Alaska and Chukotka during summer and fall**
    - **Reduced carrying capacity because of increased competition in nearshore zone for benthic prey**
    - **Increased trampling of calves during disturbances of shore haul-outs**
  - **Relaxed coupling of pelagic-benthic system resulting in lower benthic biomass of clams and invertebrates**
  - **Effects of ocean acidification on shelled invertebrates**

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# Females with calves on beaches

A. Kochnev


Photo by Cynthia Christman
NOAA Fisheries Service
AFSC, Natl Marine Mammal Lab
FFW Permit No MA212570-0

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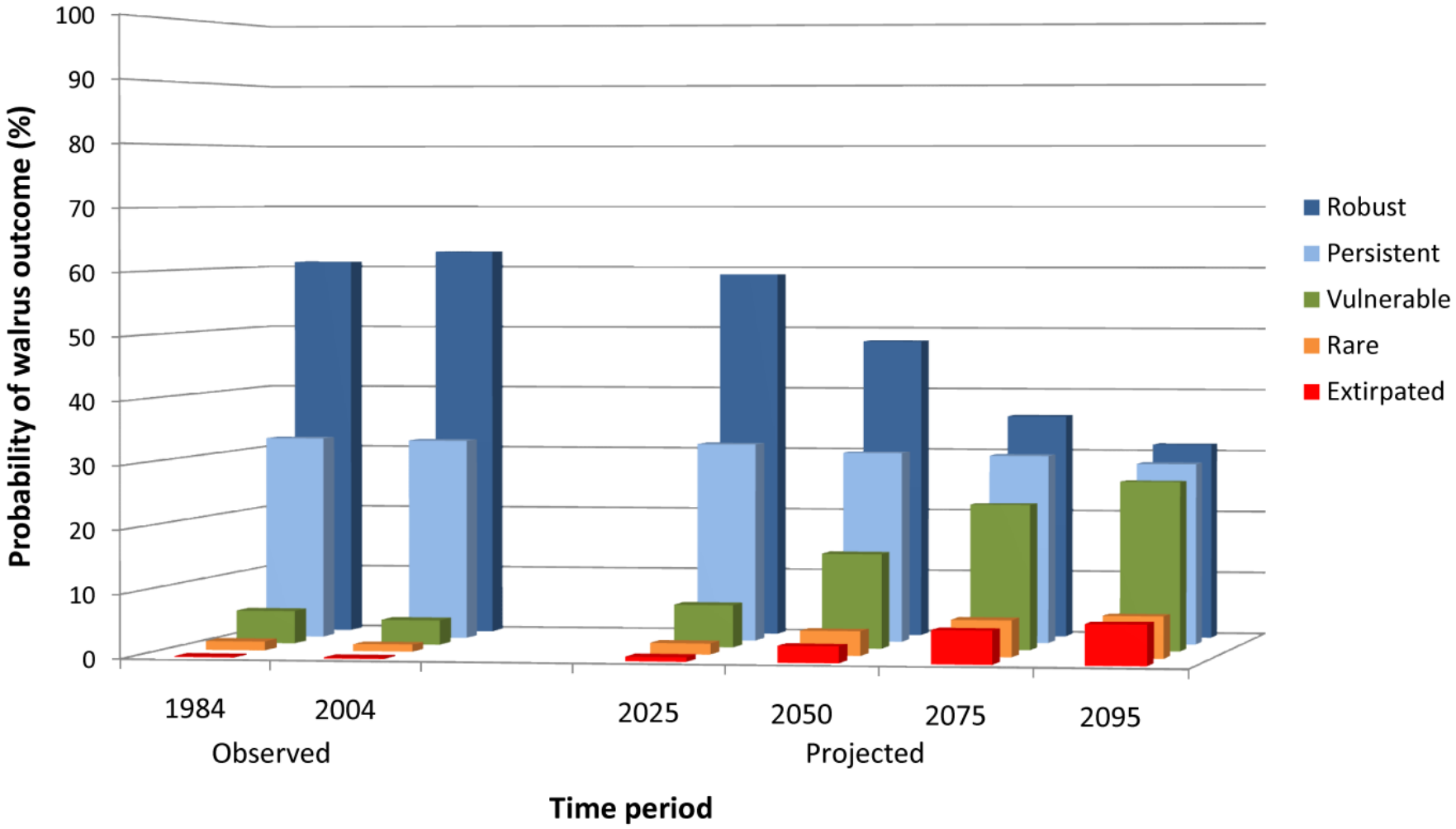
Probability of walrus outcome (%)
100
90
80
70
60
50
40
30
20
10
0
1984
2004
2025
2050
2075
2095
Observed
Projected
Time period
Robust
Persistent
Vulnerable
Rare
Extirpated

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# Winners and Losers

- **Likely winners**
  - **Seasonally migrant whales (e.g., gray, minke, fin, humpback)**
  - **Bowhead whale (short term)**
- **Likely losers**
  - **Polar bear**
  - **Walrus**
  - **Ringed seal**
  - **Bearded seal**

Ability to adapt over short time frames is key – big unknown

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# Influential U.S. Laws That Regulate Take of Marine Mammals and Influence Their Conservation and Management

- Marine Mammal Protection Act – established a moratorium on the taking of marine mammals in the U.S. except by Alaska Natives residing along the coast
- Endangered Species Act – requires that Federal activities not adversely effect listed species
- The MMPA and ESA are implemented by NOAA/NMFS for whales and seals and by USFWS for polar bears and walrus

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# Status under U.S. Endangered Species Act

- Polar bears - listed range-wide as threatened
- Pacific walrus – warranted, but listing precluded by other higher priority listing actions (candidate species)
- Ice seals – ribbon seal and spotted seal in AK– not warranted; bearded and ringed seal – status reviews completed, proposed for listing (December 2011 decision)
- Bowhead whale - endangered

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# Closing Thoughts

- Diminishing sea ice likely to have negative consequences to polar bears, walrus, ringed and bearded seals
- Less certain about impacts to other marine mammals, but range shifts likely
- Diminishing sea ice could result in increased ship traffic, development and tourism
- These in turn could impact marine mammals thru noise, disturbance and pollution
- Increasing legal complexity because of ESA listings and litigation

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